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## ON OBESITY.

By SIR LAUDER BRUNTON, M.D., F.R.S.

THE subject for discussion to-night is that of obesity, but I feel that first of all I owe an apology to the Society for attempting to introduce it when we have in our President, Dr. Allchin, one who has studied it much more thoroughly than I have done, and who could have introduced it so much better than I. My apology to you is that his position as President prevented him from opening the discussion, and it is by his request that I venture to do it.

We may begin the discussion by asking what is obesity? It is an excessive amount of fat, causing the patient to be too large to the eye, too heavy to the scales, or leading to discomfort and distress. It is sometimes difficult to give an exact definition of obesity. When a man is so stout that his body and limbs have become almost shapeless, there is no difficulty in recognising his case as one of obesity, but there are individuals who, though considerably stouter than their neighbours, are yet brisk, active, and capable of much exertion both of body and mind, the unusual amount of fat which they possess seeming to be no hindrance to their activity. One can hardly call those persons obese, and yet these very people after a short but sharp attack of influenza, which weakens the heart, may feel their weight cumbersome, and if we saw them for the first time in such a condition we should call them obese without hesitation. One may say in general terms that obesity commences when the patient's fat is obviously very much greater than normal to the eye, or when it becomes an inconvenience to himself. In order to define more accurately what I mean, it may perhaps be well to give a few numbers. The average height of an Englishman of 25 is said to be five foot eight (68 inches), and his weight ten stone five (145 lbs.). These numbers remain pretty nearly constant up to the age of 40, when the weight generally begins slightly to increase. Germans of the same age are on an average about one and a half inches taller, and weigh 5 lbs. more, while the Latin races are about 2 inches less and 7 lbs. lighter. According to Van Noorden this weight

may increase as much as 15 per cent. and still be within the normal limits. When it reaches nearly 30 per cent. one may regard them as stout, from 30 to 35 per cent. too stout, from 35 to 50 per cent. as moderately obese, and above 50 per cent. as very obese. The accumulation of fat occurs specially in the subcutaneous tissue, in the omentum, and around the heart and kidneys. Accumulation of fat in an animal or a man may depend on one or two causes: first, on too much fat or fat-forming food being taken into the body; second, on too little being burned off. These two causes may, of course, act together, and very often do. Fat consists chiefly of mixtures in different proportions of glycerine united to fatty acids. These mixtures vary in different animals, but each animal keeps its own fat pretty nearly up to a constant standard, although it may feed upon other animals having a different kind of fat. This is not altogether the case, however, for, as an old nurse of Weir Mitchell remarked, "some fats are fast, some fats are fleeting, but cod liver oil fat is soon wasted." Her keen observations showed that all fats are not alike, and this has been demonstrated by various scientists who have fed animals on fat which could easily be recognised, and more especially on a kind of fat from rape-seed oil, which has an entirely different composition from most other fats, inasmuch as glycerine is absent from its composition. Animals have not only the power of forming their own peculiar fat when they are fed upon foods of a different fat, but they are able to form fat from different kinds of food, even if fat itself is not contained in them. They can do this from foods in which fat is not contained, such as albuminates and carbo-hydrates. Under albuminates are included the flesh, that is, the muscles voluntary and involuntary of molluscs, fish, fowls, and animals of all sorts—as well as eggs—and, although not properly albuminous, tendinous structures, such as gelatine, may be included in this class. The class of carbo-hydrates includes all kinds of sugars and farinaceous stuffs, and plants containing them, as well as cellulose, or, as it is sometimes popularly called, woody fibre. But a distinction must be formed between cellulose and starches or sugars, though it consists like them of carbon, associated with hydrogen and oxygen in such proportions as will form water, and is thus a carbo-hydrate. For although sawdust may be converted by chemical means into sugar, yet, physiologically, sawdust and other forms of cellulose are not capable of being digested to any

great extent in the human organism, and therefore cellulose is not a food like starches and sugars. As the vital functions in human beings are maintained by a process of combustion, the nutritive value of foods is reckoned to some extent by the heat which each kind will give on combustion. The most convenient unit is the calorie, or amount of heat required to raise a kilogramme of water through one degree centigrade. The heat value of a gramme of dry albuminose is 4.1, that of carbo-hydrates is the same, whilst that of fat is no less than 9.3. But the body not only requires food which will yield energy, it requires also material to supply waste, and whilst albuminous materials will do both, carbo-hydrates and fat do not supply material for repair. It is therefore possible for a man to live entirely upon meat and water, but he cannot live entirely upon sugar and fat. Thus, although the nutritive value of albumens and of carbo-hydrates is the same if estimated by the quantity of heat they yield in combustion, the part they play in nutrition is entirely different. The body splits off fat with difficulty from albuminous materials, such as lean meat, but it forms fat with considerable ease from sugar and starch. The tendency to lay on fat is therefore determined, to a considerable extent, by the *nature* of the food. Individuals or races which live upon much animal food tend to be thin and wiry, while those who live much upon starchy foods and sugars have a greater tendency to plumpness. There is also a considerable difference in individuals, for just as some grates will heat a room with much less coal than others, so some persons appear to get through a good deal of work, both mental and bodily, on a small amount of food, and always look well nourished, while others who apparently work less and think less, yet eat enormously, and remain thin and hungry looking. Such individual differences probably depend, to a considerable extent, on the power of the tissues to use up the nutritive materials absorbed into the blood, and such power probably depends to a great extent on the presence of a larger or smaller quantity of enzymes. The tendency to an accumulation of fat, both in men and animals, after the removal of the testis or ovaries is well known, and in some experiments on the subjects Loewy and Richter found that in dogs the administration of ovarian extract had no effect when the generative glands were present, but increased oxidation in animals from which the ovaries or testicles had been removed. In these experiments they did not



find testicular extract have the same action. But such individual peculiarities, although of occasional importance, have much less to do with obesity in general than excessive food and deficient exercise, or a combination of both. The great majority of people, in this country at least, begin to get stouter in middle age. About this time also they become less active. While taking less exercise, they not infrequently go on taking as much food as they did when younger, or even more, because they either have attained a position where they can afford to live better, or they indulge in the pleasures of the table in place of the active amusements which they previously had enjoyed. Under these circumstances they tend to become much fatter and heavier than before, yet while bodily exercise is more fatiguing and less enjoyable, their intellects may remain quite as bright as before, and if engaged in occupation where mental activity is necessary they may be able to do their work as well as ever they did. It is usual to distinguish two forms of obesity—the plethoric and the anæmic. A most striking example of the former kind was familiar to the members of this Society some years ago in the lamented Dr. Milner Fothergill. Although so stout that on one occasion he stuck in the door of a railway carriage, and could neither get in nor out, his mental activity was very great, and his muscular strength was also very great, whilst the ruddy colour of his face and mucous membranes showed that his blood was rich and his circulation perfect. He told me that on one occasion he had made an attempt to reduce his weight. This he effected most successfully, so much so that he was not only able to run, but he could vault a five-barred gate with ease. He found, however, that when his bodily activity increased his mental activity diminished, and he deliberately gave up the attempt to keep himself in training, because he found that if he did so he would have to sacrifice all hope of attaining eminence in his profession, and be content with the life of an ordinary practitioner. The other type of obesity, the anæmic, is more often found in women whose colour is pale or tallowy, whose mucous membranes are pale, and whose muscular strength is small, and who are usually neither active in body nor mind. Such a condition sometimes comes on after profuse hæmorrhage, and may be due in considerable measure to the loss of blood. In some parts of Germany it is the custom to bleed cows in order to fatten them, and, according to the researches of Bauer, the abstraction of

blood from animals seemed to lessen the tissue change, and he explained the accumulation of fat after bleeding on the hypothesis that less oxygen was carried to the tissues, and so the fat underwent slower combustion, and consequently tended to accumulate. Some doubt has been thrown on these researches by later observers, and it has been suggested by Van Noorden that the fattening after loss of blood, and in anæmic conditions generally, is not due specially to deficiency in oxidation, but to the lessened muscular exercise which men and animals take in such a condition on account of the discomfort which they feel from the shortness of breath and languor on any exertion. It is possible that there may be a certain amount of truth in Bauer's theory, but there can be very little doubt that anything that interferes with the action of the heart tends to increase the accumulation of fat by lessening muscular exercise. Febrile disease, such as typhoid, may cause much emaciation of the patients during its progress, but after the disease is over the patients may become considerably stouter than before, partly from the increased food forced upon them to restore their strength, and partly because they eat more food to restore their strength, and they take less exercise because they are still feeble. Other diseases which lessen activity tend to cause accumulation of fat, such as chronic nephritis, on account of the languor it produces; chronic bronchitis, and emphysema, with shortness of breath on exercise; gout, rheumatism, or injury to the legs, on account of the pain and discomfort in moving, all tend to lessen the patient's activity, and consequently make him stouter. And then he enters a vicious circle. With increasing weight there comes increasing difficulty in moving. The enfeebled heart, the labouring lungs, the rheumatic muscles, have all a greater strain to bear, and the tender joints have a greater weight to sustain. Nor is the fat usually distributed evenly over the surface of the body. It tends to accumulate in those parts where the adipose tissue is normally thickest, but it has a special tendency to accumulate in the cavities of the body, in the omentum, round the kidneys, and round the heart. The breathing space is thus still further lessened, the movements of the diaphragm are restrained, the heart, encumbered by fat, acts with more difficulty, whilst the bowel, laden with fat and compressed with less energy by the thicker and feebler abdominal walls, acts with less vigour. The patient's circulation thus becomes feebler, his breath shorter, and

his bowels constipated. Moreover, the heart and liver become not merely imbedded in fat, but more or less infiltrated with fat, and the cardiac muscular fibres may even undergo fatty degeneration. In this way the general circulation becomes still feebler, and the circulation through the liver being impeded by fatty enlargement of the liver cells, the patient becomes liable to attacks of hæmorrhoids, a condition still further increased by the constipation from which the patient so frequently suffers. The impeded respiration, and the efforts required to make these slight movements, lead to much sweating, whilst eczema, boils, and carbuncles still further increase the discomfort of the patient. The trouble and discomfort which the patients experience almost make their lives a burden to them, and, in addition to their other troubles, they suffer from depression of spirits.

As the cause of obesity, either in this severe or in slighter forms, consists in the ingestion of more fat-making food than the body can burn off, its treatment naturally consists in limiting the food both in quantity and quality, and increasing the combustion of the body by accelerating the circulation. The best way of stimulating combustion is undoubtedly muscular exercise, but in severe cases we are met with the difficulty that the patient is unable to take muscular exercise. Here comes in the use of massage, by means of which the circulation through the muscles, as Tunncliffe and I have shown, may be increased three-fold, and thus the effect on tissue change obtained without any inconvenience to the patient. Moreover, by massage the work of the heart is considerably lightened. Usually the heart has to complete the circulation, and to drive blood from the left ventricle back to the right auricle; but massage takes over part of the work from the heart, and by undertaking the venous circulation for the time being, and passing much of the venous blood on from the extremities to the centre. At the same time, the skilful application of massage to the abdomen will lessen or remove constipation, which may be present. But massage alone is not sufficient. It ought only to be the preliminary to more active exercise. Until the heart is stronger the exercises should be those of gradually increased resistance, such as have been brought into vogue by Schott, at Nauheim, and as the strength increases the patient should first walk along the level ground for greater and greater distances, then up steeper and steeper inclines, according to his ability. Such walks have been laid out in this



country at Llangammarch, in Wales, and one of the best places that I have come across for them abroad is Badenweiler. But the great difficulty that one meets with in London, especially with the slighter cases of obesity, is that of time, because many men who are gradually becoming stouter cannot afford the time for walks. Some of these I find get great benefit from an hour in an institute presided over by someone who understands the treatment and can regulate it according to the requirements of each patient, and a good many City men find that it is worth their while to take an hour every day in an institute of this sort on their way to the City. But even an hour is more than some can give up, and for them I think the best thing is exercise with one of Sadow's or Whiteley's exercisers. When they are getting into good condition a punching ball becomes very useful, as they are able to take a great deal of exercise in a very short while with it. They can do this just after rising, and in 10 minutes or a quarter of an hour they will probably be perspiring, and they can then take their bath and dress. A Turkish bath once or twice a week is often both a luxury and a benefit. But exercise alone rarely suffices to bring down obesity, because exercise in itself tends to increase the appetite, and in persons who tend to get too stout, appetite not only follows but overruns the effect of exercise, and instead of getting thinner they become stouter. Excepting in institutions it is very difficult, and sometimes almost impossible, to have the solids and liquids taken by a patient weighed and measured, but the amount of food can generally be lessened very greatly by simply insisting that solids and liquids shall be taken at different times. Many people are apt to wash down food, and especially farinaceous food, without much mastication, but if the farinaceous food is of a dry kind, such as crisp toast, rusk, or biscuit, the quantity that can be got down in a given time, if fluid be withheld, becomes very much less. I am inclined to fancy, but perhaps on insufficient grounds, that there is some difference in digestion in the stomach and less tendency to form fat than when the digestive process is carried on in the intestine. The diet that I am accustomed to recommend to my patients who tend to get stout is the following:—

On awaking in the morning, sip a tumblerful of hot water with a slice of lemon in it if desired, and if the bowels are constipated half a teaspoonful or a teaspoonful of *pulverförmig* Carlsbad salts may be added to the hot water.

For breakfast take lean meat, either hot or cold, steak, chop, or cutlet, potted meats, kidney, tongue, chicken, or game, hot or cold, boiled, roast, grilled, or devilled. Fish of any kind, except herring and mackerel. The lean of bacon or ham, hot or cold. Eggs may be taken boiled, poached, or as omelet, but rather sparingly. Towards the end of the meal a breakfast cup of tea or coffee, sweetened with saccharine, may be taken. It is better without milk or cream, but still a very little may be allowed of either unless the tendency to stoutness is exceedingly great. During the meal about 1 ounce of dry toast—that is, one slice about 5 inches long, 3 broad, and  $\frac{1}{4}$  inch thick—may be slowly eaten and thoroughly chewed. If more bread is wanted, almond or gluten biscuits, gluten bread, or gluten rusks should be taken.

Between 11 and 12 a tumbler of hot water should be sipped, as already directed.

For lunch, fish, fowl, or game of any kind may be taken as at breakfast. One helping of vegetables of any kind, excepting potatoes. A baked or stewed apple may be taken, sweetened with saccharine, and a glass of claret, chablis, or hock. If the wine gives rise to indigestion it should be omitted, or a tablespoonful of whisky or brandy in a half to a whole claret-glassful of water may be substituted. The whisky or brandy should be carefully measured in a medicine glass and not in a spoon, for otherwise there may be a tendency to involuntarily increase the quantity. Gluten rusk, gluten bread, or gluten or almond biscuits may be taken if desired.

Between 4 and 5 hot water may be taken with tea, as already described, and an almond or gluten biscuit or gluten rusk may be taken with it.

At dinner fish, flesh, or fowl, vegetables, and apple may be taken as at lunch under the same restrictions. Just after dinner a cup of black coffee, sweetened with saccharine, may be taken.

At night a tumbler of water, to be sipped as already described.

In this dietary the quantity both of food and liquid is practically left at the patient's discretion or appetite, but the quality is much the same as that of a diabetic dietary, with the fat omitted. Should such a dietary as this, combined with a fair amount of exercise, not succeed in reducing the patient, it is, I think, best either to send him into a nursing home, where the quantity can be carefully regulated as well as the quality, and where exercise can be systematically carried

out during a much longer period of the day than when the patient is at his or her ordinary avocations. But if this is not practical, then I think the next best thing is to put the patient on the so-called Salisbury treatment, which is very much like what was formerly recommended by Harvey and Banting, plus the addition of hot water. The Banting treatment practically consists in starving the body of fat-making material by feeding entirely on meat, from which fat is formed with difficulty. The disadvantage of this treatment consists in the fact that while little material is afforded for the formation of fat, an excessive amount of nitrogenous waste products occurs in the blood, and unless they are freely eliminated may produce poisonous results, such as languor, nervousness, and insomnia. By taking a large quantity of hot water between meals the excretion of the products of muscular waste is greatly quickened, and this danger is to a great extent averted. The Salisbury system, as expounded by Mrs. Stuart, is to take lean beef and minced beef only for meals, and take hot water between times. The meat should be freshly killed and finely minced by sending it through a sausage machine three times; all the fat, gristle, and connective tissue should be removed; the minced meat made up lightly into cakes, seasoned with pepper and salt, and moistened with good soup and grilled. Or the minced meat thus prepared may be mixed with cold meat soup, free from fat, in the proportion of 1 pint to  $1\frac{1}{2}$  lb. of mince, and heated over a gentle fire till thoroughly cooked, but not brought to the boil. If the patient cannot take mince-meat alone, some small digestive biscuits, or bread roasted crisp in an oven, and butter may be taken in the proportion of one mouthful of either of these to four or six of the mince. Such a dietary as this may sometimes be carried on for two or three years without any bad result, but where the patient, not knowing the reason for the hot water, has limited this and still continued the mince-meat, disadvantageous results have arisen, just as in the Banting system. There is no doubt, I think, that the use of thyroid extract increases tissue change, and will reduce fat considerably, but I think in most cases it is advisable to diminish obesity rather by attention to feeding and exercise than by the use of thyroid. I have seen the nervousness, tachycardia, and tremor, so characteristic of Graves' disease, produced by patients taking thyroid too long without supervision.

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